

WHAT IS CLAIMED IS:

1. A purified nucleic acid that is hybridizable under moderately stringent conditions to a nucleic acid having a nucleotide sequence corresponding to or complementary to the nucleotide sequence shown in Figure 2 (SEQ ID NO:1).
- 5 2. The nucleic acid of Claim 1 that is hybridizable under moderately stringent conditions to a nucleic acid having a nucleotide sequence corresponding to or complementary to a portion of the nucleotide sequence shown in Figure 2 (SEQ ID NO:1) that encodes a functionally active glycosyltransferase.
- 10 3. The nucleic acid of Claim 2 that encodes a functionally active glycosyltransferase.
4. The nucleic acid of Claim 1 that has a nucleotide sequence corresponding to or complementary to a portion of the nucleotide sequence shown in Figure 2 (SEQ ID NO:1) that encodes a functionally active glycosyltransferase.
- 15 5. The nucleic acid of Claim 4 that encodes a functionally active glycosyltransferase.
6. The nucleic acid of Claim 1 that has a nucleotide sequence corresponding to or complementary to the nucleotide sequence shown in Figure 2 (SEQ ID NO:1).
- 20 7. The nucleic acid of Claim 3, wherein the functionally active glycosyltransferase catalyzes a reaction selected from the group consisting of:
  - a) adding Gal  $\beta 1 \rightarrow 4$  to GlcNAc or Glc;
  - b) adding GalNAc or GlcNAc  $\beta 1 \rightarrow 3$  to Gal; and
  - c) adding Gal  $\alpha 1 \rightarrow 4$  to Gal.

8. The nucleic acid of Claim 3 which encodes a glycosyltransferase having an amino acid sequence of SEQ ID NO:2.

9. The nucleic acid of Claim 3 which encodes a glycosyltransferase having an amino acid sequence of SEQ ID NO:3.

5 10. The nucleic acid of Claim 3 which encodes a glycosyltransferase having an amino acid sequence of SEQ ID NO:4.

11. The nucleic acid of Claim 3 which encodes a glycosyltransferase having an amino acid sequence of SEQ ID NO:5.

12. The nucleic acid of Claim 3 which encodes a glycosyltransferase having an 10 amino acid sequence of SEQ ID NO:6.

13. An expression vector comprising the nucleic acid of Claim 3 operatively associated with an expression control sequence.

14. A recombinant host cell transformed with the expression vector of Claim 13.

15 15. A method for producing a glycosyltransferase comprising:

- culturing the recombinant host cell of Claim 14 under conditions that allow expression of the glycosyltransferase; and
- recovering the expressed glycosyltransferase.

16. A glycosyltransferase having an amino acid sequence of SEQ ID NO:2, or 20 a functionally active fragment thereof.

17. A glycosyltransferase having an amino acid sequence of SEQ ID NO:3, or a functionally active fragment thereof.

18. A glycosyltransferase having an amino acid sequence of SEQ ID NO:4, or a functionally active fragment thereof.

19. A glycosyltransferase having an amino acid sequence of SEQ ID NO:5, or a functionally active fragment thereof.

5 20. A glycosyltransferase having an amino acid sequence of SEQ ID NO:6, or a functionally active fragment thereof.

21. A composition comprising a glycosyltransferase conjugated to a solid phase support, wherein the glycosyltransferase is selected from the group consisting of:

10 a) a glycosyltransferase having an amino acid sequence of SEQ ID NO:2, or a functionally active fragment thereof;

b) a glycosyltransferase having an amino acid sequence of SEQ ID NO:3, or a functionally active fragment thereof;

c) a glycosyltransferase having an amino acid sequence of SEQ ID NO:4, or a functionally active fragment thereof;

15 d) a glycosyltransferase having an amino acid sequence of SEQ ID NO:5, or a functionally active fragment thereof; and

e) a glycosyltransferase having an amino acid sequence of SEQ ID NO:6, or a functionally active fragment thereof.

22. A method for adding GalNAc or GlcNAc  $\beta$ 1 $\rightarrow$ 3 to Gal, comprising 20 contacting a reaction mixture comprising an activated GalNAc or GlcNAc to an acceptor moiety comprising a Gal residue in the presence of the glycosyltransferase of Claim 16.

23. A method for adding Gal  $\beta$ 1 $\rightarrow$ 4 to GlcNAc or Glc, comprising contacting a reaction mixture comprising an activated Gal to an acceptor moiety comprising a 25 GlcNAc or Glc residue in the presence of the glycosyltransferase of Claim 17.

24. -A method for adding Gal  $\alpha 1\rightarrow 4$  to Gal, comprising contacting a reaction mixture comprising an activated Gal to an acceptor moiety comprising a Gal residue in the presence of the glycosyltransferase of Claim 18.

25. A method for adding GalNAc or GlcNAc  $\beta 1\rightarrow 3$  to Gal, comprising  
5 contacting a reaction mixture comprising an activated GalNAc or GlcNAc to an acceptor moiety comprising a Gal residue in the presence of the glycosyltransferase of Claim 19.

26. A method for adding Gal  $\beta 1\rightarrow 4$  to GlcNAc or Glc, comprising contacting a reaction mixture comprising an activated Gal to an acceptor moiety comprising a  
10 GlcNAc or Glc residue in the presence of the glycosyltransferase of Claim 20.

27. A method for preparing an oligosaccharide having the structure  
Gal $\alpha 1\rightarrow 4$ Gal $\beta 1\rightarrow 4$ Glc, which comprises sequentially performing the steps of:  
a) contacting a reaction mixture comprising an activated Gal to an  
acceptor moiety comprising a Glc residue in the presence of a  
15 glycosyltransferase having an amino acid sequence of SEQ ID NO:6, or a  
functionally active fragment thereof; and  
b) contacting a reaction mixture comprising an activated Gal to the  
acceptor moiety comprising Gal $\beta 1\rightarrow 4$ Glc in the presence of a  
glycosyltransferase having an amino acid sequence of SEQ ID NO:4, or a  
20 functionally active fragment thereof.

28. A method for preparing an oligosaccharide having the structure  
Gal $\beta 1\rightarrow 4$ Glc, which comprises contacting a reaction mixture comprising an  
activated Gal to an acceptor moiety comprising a Glc residue in the presence of  
the glycosyltransferase of Claim 20.

29. A method for preparing an oligosaccharide having the structure  $\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$ , which comprises contacting a reaction mixture comprising an activated GlcNAc to an acceptor moiety comprising a  $\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of the glycosyltransferase of Claim 16.

5 30. A method for preparing an oligosaccharide having the structure  $\text{Gal}\beta 1\rightarrow 4\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$ , which comprises contacting a reaction mixture comprising an activated Gal to an acceptor moiety comprising a  $\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of the glycosyltransferase of Claim 17.

10 31. A method for preparing an oligosaccharide having the structure  $\text{GalNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$ , which comprises contacting a reaction mixture comprising an activated GalNAc to an acceptor moiety comprising a  $\text{Gal}\beta 1\rightarrow 4\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of the glycosyltransferase of Claim 19.

15 32. A method for preparing an oligosaccharide having the structure  $\text{GalNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$ , which comprises sequentially performing the steps of:

20 a) contacting a reaction mixture comprising an activated Gal to an acceptor moiety comprising a Glc residue in the presence of a glycosyltransferase having an amino acid sequence of SEQ ID NO: 6, or a functionally active fragment thereof;

b) contacting a reaction mixture comprising an activated GlcNAc to the acceptor moiety comprising a  $\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of a glycosyltransferase having an amino acid sequence of SEQ ID NO:2, or a functionally active fragment thereof;

25 c) contacting a reaction mixture comprising an activated Gal to the acceptor moiety comprising a  $\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the

presence of a glycosyltransferase having an amino acid of SEQ ID NO:3; and

5 d) contacting a reaction mixture comprising an activated GalNAc to the acceptor moiety comprising a  $\text{Gal}\beta 1\rightarrow 4\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of a glycosyltransferase having an amino acid sequenc of SEQ ID NO:5, or a functionally active fragment thereof.

33. A method for preparing an oligosaccharide having the structure  $\text{Gal}\beta 1\rightarrow 4\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$ , which comprises sequentially performing the steps of:

10 a) contacting a reaction mixture comprising an activated Gal to an acceptor moiety comprising a Glc residue in the presence of a glycosyltransferase having an amino acid sequence of SEQ ID NO: 6, or a functionally active fragment thereof;

15 b) contacting a reaction mixture comprising an activated GlcNAc to the acceptor moiety comprising a  $\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of a glycosyltransferase having an amino acid sequence of SEQ ID NO:2, or a functionally active fragment thereof; and

20 c) contacting a reaction mixture comprising an activated Gal to the acceptor moiety comprising a  $\text{GlcNAc}\beta 1\rightarrow 3\text{Gal}\beta 1\rightarrow 4\text{Glc}$  residue in the presence of a glycosyltransferase having an amino acid of SEQ ID NO:3.